STRATEGY RESEARCH PROJECT

AFTER RECOGNITION COMES IMPLEMENTATION: THE CHALLENGES FOR THE INFORMATION AGE REVOLUTION IN MILITARY AFFAIRS

BY

LIEUTENANT COLONEL DANIEL R. JUDY
United States Army

USAWC CLASS OF 1997

U.S. ARMY WAR COLLEGE, CARLISLE BARRACKS, PA 17013-5050

USAWC STRATEGY RESEARCH PROJECT

AFTER RECOGNITION COMES IMPLEMENTATION: THE CHALLENGES FOR THE INFORMATION AGE REVOLUTION IN MILITARY AFFAIRS

by

LTC Daniel R. Judy

Lieutenant Colonel Steven R. Lindberg

Project Advisor

U.S. Army War College

Carlisle Barracks, Pennsylvania 17013

ABSTRACT

AUTHOR: Daniel R. Judy (LTC), USA

TITLE: After Recognition Comes Implementation:
The Challenges for the Information Age Revolution in Military Affairs

FORMAT: Strategic Research Project

DATE: 18 April 1997 PAGES: 41 CLASSIFICATION: Unclassified

An unprecedented rate of improvement on the order of a ten-fold increase every 3 to 4 years has occurred in information technology. It been called an explosion, and it has propelled the United States into the Information Age. The Chairman of the Joint Chiefs of Staff addressed the resulting impact on the military during promulgation of Joint Vision 2010. He stated "we are already in the midst of a Revolution in Military Affairs caused by the explosion." However, the totality of this is not well understood as current strategic concepts do not cleanly address the meaning of a "Revolution in Military Affairs (RMA)." Serious apprehension surrounds the discussion because the composition and fabric of the Army could clearly be affected. In this research project, the notion of an Information Age RMA is explored. Framing the review is an examination of the current geostrategic and domestic environments and the Army's corresponding activities. It is concluded that three important actions must occur to enact an RMA. First the RMA concept must be clearly defined and understood. Secondly, a goal or "vision" must exist. Finally, an implementation plan must be written to direct purposeful action. Recognizing these ideas are paramount to successful execution of an Information Age RMA.

TABLE OF CONTENTS

1. INTRODUCTION.

> ***"We live in an age that is driven by information. Technological breakthroughs ... are changing the face of war and how we prepare for war."***
>
> ***William Perry, former Secretary of Defense***[1]

Much has been said and written about the Information Age, and understandably so because of its enormous impact in the world. The convergence of the remarkable advances in the communications and computer technologies has resulted in a world situation not foreseen by the generations preceding this. In the last 20 years there have been dramatic, exponential changes in the way we live and do business. Likewise, the Information Age technologies are having profound impact on the National Security Strategy and the manner in which the Army supports it through the National Military Strategy. The Army's intensive, multi-year efforts and multi-million dollar expenditures in the equipping, evaluating and testing of the Force XXI "digitized" brigade at Ft Hood, Texas, illustrates the magnitude of the effort as the Army struggles to posture for the Information Age. Ultimately, a successful National Military Strategy will be one which postures the Nation in a position of information superiority in the coming generation.

The dramatic metamorphosis of the Army that will occur as a result of the movement from the Industrial Age to the Information Age is not fully known. It is postulated by many that it will require a Revolution In Military Affairs (RMA). Indeed the Chairman, Joint Chiefs of Staff (CJCS) totally endorsed that view affirming in his statement about the vision for the future, "We are in the midst of a revolution in military affairs."[2] Never-the-less, how that will proceed is not clearly defined. Nor is the totality

of what a revolution in military affairs entails universally agreed upon. The CJCS followed his comment with direction and a caveat for proceeding. He asserted, "Rapid technological changes must and will force changes in organization, training, and operations. If there is one certainty, it is that the revolution will cause us to either maintain our edge or lose it."[3] That directs serious concern and ominous challenge for the military and the Nation. That challenge must be confronted and resolved if we are to continue in the next century with the degree of preeminence that prevails today.

This paper examines the current Information Age environment, reviews the evolution of the RMA concept, and examines those activities that have been undertaken in the Army as a result. The current geostrategic and domestic environments are looked at to determine the applicability of an RMA and, based upon the conclusions, direction is proposed to ensure support to a National Military Strategy that is prepared to meet the challenges in the 21st century. This paper presents recommendations for directing efforts in implementing an Information Age RMA process to accomplish the Army Vision 2010 ideas. In doing so it is believed that only through aggressive, purposeful action can Information Age advantages be capitalized on to ensure the successful preservation of national security in the future.

2.0. THE REVOLUTION IN MILITARY AFFAIRS.

> ***"I think what you're seeing here is a revolution in military warfare ... So, we look to the future. The future is as Toffler says, 'Unless you tame technology, you will encounter future shock.' We're not only taming technology, we are turning technology into not future shock, but future security."***
>
> ***William S. Cohen, Secretary of Defense, at Force XXI AWE[4]***

2.1. The Information Age.

Change unprecedented in the lifetime of any currently serving member of the armed forces is occurring. We have moved into the Information Age. The change is well acknowledged in the world, our country, and our homes. It is marked by both the remarkable rapid technological advances and the resulting convergence of communications and computers. It has been spurred by the development of the microprocessor and the subsequent radical improvements since. Computers, faxes, videoconferences, cellular phones, fiber optics, et. al. are visible commonly used examples of the spread of this technology.

Twenty five years ago Intel Corporation developed the first microprocessor for general use. It boasted 2.3 thousand transistors capable of 60 thousand instructions per second. Today's microprocessor provides the power of 5.5 million transistors capable of 321.5 million instructions per second. In the year 2000 Intel will have a microprocessor that has 100 million transistors performing 2 billion instructions per second![5] That phenomenal development and performance growth, a doubling about every 18 months, is expected to continue for the next 10 to 30 years.[6] This exponential rate of change has long been recognized within the information technology industry, receiving a degree of institutional recognition akin to that of an irrefutable law of science and correspondingly referred to as "Moore's Law."[7]

Aided by the concurrent development in telecommunications capabilities, the explosion has made the computer a powerful communications and knowledge awareness device. For example, in 1982 the common data transmission rate across a

communications modem was 300 bits per second (bps). Today it is 33,600 bps. In 1997 it will be 56,000 bps. More astonishing is to reflect on the phenomenon provided by the Internet and the World Wide Web. The "net" has progressed from virtual non-existence a decade ago to an estimated 80 million "homepages" today. Expectation for tomorrow appears unbounded as indicated by Microsoft's Bill Gates' premonition, "There's more to be done on the Internet than has been done to date."[8] All together the development and use of information technology has been explosive and is truly revolutionary.

As might be expected, order of magnitude growth has phenomenal impact on institutions and cultures. The Institute for National Strategic Studies at the National Defense University noted in its Strategic Assessment 1996, "While societies have often been confronted with profound social changes owing to advancing technological changes, never before have societies been forced to adapt to a technology which for decades has been improving by an order of magnitude every three to four years."[9] The extent of this growth is reflected in the U.S. today by the fact that over 60 percent of the total workforce is now engaged in information-related activities.[10] Yet, with this identified and proven trend in explosive, exponential growth, the most remarkable impacts are those to come.

The U.S. armed forces certainly are not exempt from all this. The implications of exponential growth of information technology are just as remarkable and revolutionary in the military as they are in society. "Information is power" is a truism. In the military the technology has radically advanced the capability to collect, process, integrate, and disseminate information and thus has enhanced power. The result is improved clarity in

the fog of war. Commanders can move, shoot and communicate more accurately, effectively, and quickly. Information systems embedded in weapons systems are carrying out complex, automated execution based upon battlefield sensing. Processed information has given the commander power which he never before experienced. In fact, a great deal of the overwhelming superiority of the U.S. military is attributed to its application of technological superiority. It has generally been noted, for example, that the smashing U.S. victory in the 1991 Gulf War "demonstrated unprecedented mastery of conventional warfare - especially in the area of information technologies."[11]

2.2. Definitions.

Although transformations in equipment, organizations, operations, and character of the Army have occurred as natural processes throughout the years, the current environment has generally been perceived as different. The indication is that today's change reflects the exponential characteristic of the Information Age. Former Army Chief of Staff General Gordon Sullivan and Colonel James Dubik recognized the dramatic nature of the change that was facing the military when they forecast what would occur as the U.S. Army moved into the Information Age:

> Warfare conducted by an information age army will be as distinct from warfare conducted by an industrial age army as that form of warfare was from war made by an agrarian age army.[12]

In general, the transformation in the military that occurs with extraordinary developments has come to be known as a Revolution in Military Affairs (RMA). The current likelihood of a Revolution in Military Affairs occurring has been widely debated. It has been the focus of military "think tanks", the subject of study for Defense Science

Boards, a topic in academia and the military academic institutions, the concern of the Pentagon and Defense staffs, and the object of numerous studies for the DOD.

To the historian and academician the retrospective discussion of the opportunities and advantages achieved during periods of great change, the fortuitous outcomes of events as a result of Revolutions in Military Affairs, are scintillating topics. For example, to reflect on the impact and consequential affects that occurred with the advent of gunpowder is engaging dialogue. But it would be hard to believe that the militiaman, trying to reload his musket while skilled enemy archers at long range felled his comrades, reflected on how grand the introduction of gunpowder and muskets were to his ability to conduct warfare. Such a hypothetical example illustrates the difficulty that characteristically surrounds the exploration of radical change of the present environment -- it is hard to conceptualize the magnitude and the significant consequences of a changing environment without the benefit of matured thought.

While discussing the current state of affairs to a successful military officer, even the phrase Revolution in Military Affairs can evoke understandable indignation and sometimes a reaction of emotional repulsion. This is understandable because revolutionary change implies a dramatic altering of the status quo and with it the established hierarchy. That is uncomfortable thinking for the established hierarchy. Institutions that have demonstrated success are naturally inclined to avoid fundamental change (as well as discussions that imply the same). Even the word "revolution" makes one sense a state of conflict. An ill-favored preconception that results from use of the phrase might even be a roadblock to energizing meaningful internal progress. Today the

Information Age causes us to face dramatic change and therefore determine what a Revolution in Military Affairs is all about. As such, it is extremely important to get past superficial understanding and to clearly comprehend what it is that is being discussed in order to progress.

Complicating the issues of RMA recognition and implementation are the lack of an agreed upon definition. Although there seems to be acknowledgment that today's environment might be that of an RMA, a lack of preciseness in definition blurs understanding and consensus. The discussions of past RMAs and a possible present day RMA have revolved around discussions of the types, characteristics, phases, and components of RMAs.

Because the field of study itself is relatively new, the difficulty of defining the concept is understandable. One particular study discusses the RMA concept resolving that "there is no accepted definition of RMAs or even agreement on which historical transformations constituted revolutions."[13] It then continues to describe the concept, stating "throughout history, warfare usually developed in an evolutionary fashion, but occasionally ideas and inventions combined to propel dramatic and decisive change."[14] There are others that have given much more precise and succinct definition, such as the definition that an RMA is an "historical discontinuity in the conduct of warfare."[15]

Certainly transformations that fit the RMA "idea" occurred in the past, but the thought of an identified, structured process around which radical change in the military happens was only first introduced by Soviet writings in the late 1970s and early 1980s, particularly in a series of papers by Marshall N. V. Ogarkov.[16] Ogarkov's analysis dealt

with the revolutionary impact of new technologies on the military. When the topic was investigated and developed by the U.S. defense community, the initial focus followed Ogarkov's concentration on technology and resulted in a focus on the study of "military technical revolutions (MTR)."[17] By centering on technology, the military technical revolution study was limited and did not capture the full concept, and the interested community moved to direct the focus on revolution with technology in a subordinate role. This introduced the term "revolution in military affairs."[18]

Clarity in defining concepts is not simply an academic exercise. Within the community, the definitions provide the basis for constructive dialogue and development. A vague understanding of the concept does not satisfy the need for a definition. The precision in definition allows for focused development and further progressive action. The Institute for National Strategic Studies (INSS) put a degree of definitiveness in the RMA concept. They begin by defining a **Military Technical Revolution (MTR) as "the incorporation of radically advanced capabilities into existing military forces as equipment turns over."**[19]

Today that MTR process is occurring in the military's modernization programs. Examples include the upgrade to the M1A2 tank, which is an infusion of information technology based enhancements; the planned incorporation of asynchronous transfer mode (ATM) switching in the Army's principal telecommunications assemblages (Mobile Subscriber Equipment); the explosive increase of processors and embedded software in aircraft, where the Air Force has steadily increased the number of lines of

software in aircraft from 28,500 in the F-4G to 507,000 in the F-15C to 1,600,000 in the F-22[20]; and on and on in virtually every modernization or upgrade that is planned.

Following the definition of an MTR, the INSS defines a **Revolution in Military Affairs (RMA) as "the adoption of radically more effective operational procedures and organizations in response to the opportunities offered by an MTR."**[21] It is significant to note three points: 1) the RMA presupposes the MTR; 2) the RMA is active not passive; and, importantly, 3) during an RMA ***changes in the organization structure and the doctrine must occur*** concurrent with the incorporation of the technological enhancements.[22]

The INSS definitions of MTR and RMA best capture the ideas that have surrounded the dialogue on the subject. They provide the degree of clarity and specificity necessary to promote further study. With the acceptance of these definitions, the study and implementation issues can be examined and progressive actions taken. As these definitions provide a sufficient basis, they are accepted herein to define the concepts, and it is suggested that they be used to provide the foundation for further action.

2.3. Historical Review.

A retrospective look at RMAs should provide a degree of understanding and help to guide current action. However, in the RMA writings the fuzziness of the concept is again encountered and can be distracting. For example, in looking at history since the 14th century, analysts have described there being two RMAs (Alan and Heidi Toffler),[23] ten RMAs (Andrew F. Krepinevich),[24] five RMAs (Jeffrey R. Cooper - whose counts starts with the Napoleon era),[25] et. al. Nonetheless, the review of these periods of

interest allows an analysis of the impact that the radical changes had on the state of affairs at the time and of conditions surrounding the events. If examined in the context of the INSS definitions, meaningful insight can be gleaned to help in the present day dialogue.

Perhaps one of the most thorough reviews of previous RMAs was done by Jeffrey R. Cooper. Although Cooper does not offer concise criteria and a crisp definition to judge whether periods of interesting radical change are to be called RMAs, the examples he provides all meet the INSS definition. What Cooper does is describe his RMAs and categorize them by type. There are, he contends, three types: the first is driven by new, purely military technology, the second is driven by operational innovation to redress a strategic problem, and the third is driven by fundamental economic, political and social changes that are outside the military domain.[26] Specifically, Cooper identifies the previous RMAs as: 1) the Napoleon "nation in arms" RMA, 2) the railroad, telegraph and modern manufacturing "mobile warfare" RMA, 3) the World War I mass production "static, attrition warfare" RMA, 4) the internal combustion engine, aircraft, and radio "mobility, maneuver, and initiative warfare" RMA, and 5) the "nuclear and long-range strike" RMA.[27]

A classification of Cooper's five identified RMAs by type, groups the nuclear and long-range strike RMA as being the first type (driven by technology), the Napoleon RMA as being the third type (driven by economic, political and social changes), and the rest as being the second type (driven by operational and organizational changes). It is important to note that the most common of the RMAs has been the second type. This type requires the least amount of resourcing and has often been created by a previously defeated body.

It is illustrative to examine the Blitzkrieg in this context of definition and typing. Although many believe the technological advancements of the tank, airplane, and radio are the drivers for the Blitzkrieg, it is actually a prime illustration of Cooper's second type, one mostly driven by operational and organizational changes.[28] It was the ability of the Germans to combine the technological enhancements and, most importantly, design tactics and formations using the technology that made it an RMA. Additionally, it is significant to note that the technological enhancements employed by the Germans were not new but had been employed by other armies since World War I. The key was that the Germans, after being defeated in World War I, accomplished an RMA and a "leap-ahead" by taking actions that coupled radical technology, organization, and operational change.

3.0. THE MILITARY IN THE INFORMATION AGE ENVIRONMENT.

"Information may come to rival explosive force as a factor in warfare."
Strategic Assessment 1996, INSS, NDU[29]

3.1. The Army Movement into the Information Age.

The Army has taken heed of the implications of the Information Age. As Chief of Staff, General Gordon Sullivan began a concerted effort to preclude what he recognized as a fateful condition that had fallen on previous post-war armies which left them unprepared. He described a sinusoidal pattern of peaks and dips that occurred in the readiness of our Army throughout the years. The Army finished a era where it had demonstrated excellence in the Gulf War - at a peak in the curve - and faced a time of massive reduction. General Sullivan was intent on precluding the natural downward decline in readiness and preventing the conditions that would allow a "Task Force Smith"

situation to occur. In order to determine how to prepare for the future, he organized a process patterned after General George C. Marshall's Louisiana Maneuver exercises during the period between the World Wars. As General Marshall had done previously to prepare the U.S. Army's pending involvement with World War II by experimentation and exercises in his Louisiana Maneuvers, General Sullivan used a process to energize and focus the forces of change while maintaining today's trained and ready Army.[30]

After formulating the direction to take, General Sullivan initiated the Force XXI effort to shape the context for the future, with a goal to exploit information technologies for greater efficiencies and higher performance under all conditions.[31] Key to the efforts of Force XXI is the process to "digitize" the Army as it transforms into the 21st century. This process of digitization, as defined by the Army Digitization Office, involves

> the application of information technologies to acquire, exchange, and employ timely information throughout the battlespace, tailored to the needs of each decider (commander), shooter, and supporter, allowing each to maintain the clear and accurate vision of the battlespace necessary to support mission planning and execution.[32]

The stated goal of the Force XXI effort is to have brigade, division, and corps digitization experiments and evaluation completed by 3rd quarter 1998. The commitment by the leadership to infuse information technology into the Army is reflected in this undertaking.

Subsequent to the initiation of the Force XXI effort, current Chief of Staff, General Dennis Reimer, initiated a process to focus study on the year 2025; titled the Army After Next (AAN) Project. The intent of the effort is to conduct studies of warfare in year 2025, frame issues vital to the development of the Army after 2010, and provide issues to senior leadership for integration into combat development programs.[33] The

results of the AAN would be used to shape the processes to prepare the force necessary to fight in the environment after the Force XXI environment. The product of the AAN has even been described as the "RMA Army."[34]

As Force XXI and AAN efforts progressed the Army issued its vision "blueprint" to guide the development of the personnel and technology in executing the requirements of the future. As stated "the Army Vision 2010 identifies the patterns of operation, concepts, enablers and technologies the Army needs in the 21st century to convert its vision into reality."[35] In addition to prescribing how the Army will fight in the early 21st century, the document states that "Army Vision 2010 also serves as the linchpin between Force XXI, the Army's ongoing process to manage change and advance into the 21st Century with the most capable Army in the world, and the Army After Next (AAN), the Army's emerging long-term vision."[36]

Thus, the Army process for the Information Age is depicted as one that develops through the Force XXI experiment from now to the early part of the century, to the structure capable of "full spectrum dominance" as articulated in Army Vision 2010, to the AAN "RMA Army" in 2025. The relevant and interesting question is which of these can and/or will be an RMA Army.

3.2. The Existing Environment.

Underlying the discussion of a current day RMA is whether there is a need for near term implementation of organizational changes and operational changes in the Army, or, in other words, whether MTR enhancements alone are sufficient while evolution occurs as it has in the past. As previously outlined, because of the complete

impact and the magnitude the information revolution has had on our ability to conduct business, the Army is compelled to embrace the radical changes of the Information Age sooner or later. Consequently, an MTR will occur. Meanwhile the speed at which developments in society and the embedding of the information technology in the military is occurring will not allow casual attention; the technology is being employed now. In fact, review of the Force XXI efforts affirms that it is already pervasive in the Army.

Because of the current geopolitical environment and the domestic concerns it is also beneficial that the MTR occur now. The loss of our premier major threat, the Soviet Union, causes deep introspection for the security forces of the U.S. To structure and operate the Nation's armed forces requires an understanding of what the threat is or might be. In the past, the "peer competitor" Soviet Union made it easy for both for the Pentagon as well as the American taxpayer. Today there is no easy solution, but rather a multitude of possibilities. Concurrently, the realities of domestic concerns ensure that the military will not be allowed to build to defeat, in kind, every conceivable threat. Other real and immediate concerns argue for the federal treasury coffers. Moreover, it is also obvious that there are other elements of national power (diplomatic, economic, political, and information) that can be applied to the national security needs. Thus, building a capabilities-based force vice a threat-based force is being pursued. With that methodology, the force enhancements gained from the MTR are realized.

The result of there not being a large, single-focused threat while there are domestic economic problems, pushes hard for change. Surprisingly, in analyzing the situation and the possible force structure options, the Institute for National Strategic

Studies recently concluded an "accelerated RMA force" option will achieve cost savings when compared with the other possible force structure options. While in a period of low threat, the "accelerated RMA force" captures the efficiencies gained by full, near-term integration of the technologies.[37]

The armed forces are conducting the 3rd major force review since the demise of the Soviet Union. The Congressional mandated Quadrennial Defense Review (QDR) and the subsequent National Defense Panel (NDP) are enacted to drive change necessitated by the geostrategic and domestic environments. Force structure, end strength, capabilities, and strategy are all involved and subject to change. Changes will undoubtedly happen as a result of the QDR and the NDP. In fact, an early QDR forecast reduced the Army force structure by 2 divisions, the Navy by 2 air wings, and the Air Force by 3 fighter wings.[38] Subsequent predictions slashed active end strength by 60,000 to 100,000. The opportunity is there for technological enhancement, organizational, and operational changes in the Army.

3.3. The Military Threat and Concern.

An important reality and concern for the National Military Strategy (NMS) is the recognition of the most likely employment of the military in the near term. Engagements on the left side of the spectrum of conflict, the Military Operations Other than War (MOOTW), will happen; a World War III is not likely. As the Department of the Army illustrated in its new vision document, in the 40 years preceding the demise of the Soviet Union, forces deployed 10 times; in the 6 years since, they have deployed 25 times[39] (figure 1). There is no indication that this will change in the near future. Therein is the

dilemma. Regardless of concerns by many, both within and outside of the Department of Defense, about the armed forces being too focused on the far left of the spectrum of conflict, as long as the Administration, the Congress, and the People perceive the need for action across the full spectrum of conflict, the military will be employed to meet it. Today, the action is on the left side of the spectrum. These engagements are different than those planned when the military needed to engage the Soviet Army as it deployed through the Fulda Gap.

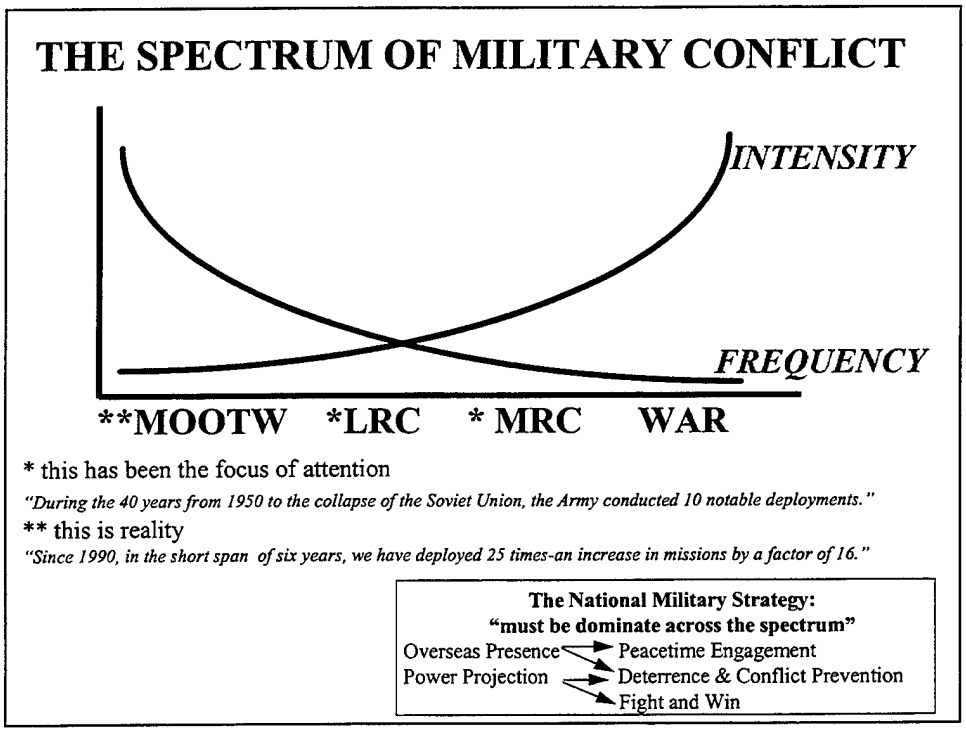

Figure 1

Moreover, today on the right side of the spectrum of conflict, when there might be action, the action is "different" then it was in the past. Among the numerous recent deployments was the anomaly with the Gulf War. Paradoxically, even that seemed to

confirm to the American people the need for a technologically superior military force and a new type of warfare to use in a "major" conflict: the ability to have a "stand-off" approach using unmatched technological superiority, enhanced battlefield "sensing," and smart, precision guided munitions after which the required "conventional" application of the military in a major conflict would only necessitate a "100 hour rout" using "conventional" application of forces on the ground. In fact, Desert Storm was arguably the immature initiation into warfare in the Information Age.

The threat for the near future is obscure. One of our Major Regional Contingency (MRC) threats, North Korea, is diminishing rapidly. The Director of Central Intelligence (DCI), John M. Duetch, reported to the U.S. Senate Intelligence Committee in December 1996 that North Korea as we know it will not exist in 2 to 3 years.[40] The second MRC threat, Iraq, has not recovered from the defeat of Desert Storm. With war-damaged and aging equipment, greatly eroded support capability, questionable force composition, and a poor economy, Iraq is severely challenged.[41] China and Russia are at least a decade away from being viable global peer-competitor threats.[42]

The key notion is the recognition that with the geostrategic conditions in the world today, there exists a "strategic lull." The U.S. has no global peer (the right side of the spectrum of conflict is clear), the most likely conflicts are the least threatening, and the most challenging are unlikely to occur.[43] At the same time the U.S. "awareness" of the world situation has dramatically improved since the Gulf War. It is highly debatable whether a classical meeting engagement of large land forces could ever occur without our allowing it. This allows the U.S. the opportunity to capitalize on change with less risk.

This environment begs for NMS change. The debate for the military should not be which is the correct employment of the armed forces. In the foreseeable future that is predetermined in the geopolitical world for the U.S. armed forces. It is instead the composition of the military such that there will be the capability to conduct successful operations across the full spectrum of conflict. The debate should be internal to the armed forces by the military professionals with the geopolitics accepted (not debated) and with the active acceptance of MOOTW. Progress is achieved at the point when the advances from information technology are honestly acknowledged and explored, recognizing the possible radical implications. The opportunity presented by the "strategic lull" should be taken. The MTR is occurring, but actions need to be identified and established to execute organizational restructure and operational changes. That means an RMA.

4.0. DIRECTION.

"The enemies of successful change are complacency and arrogance."[44]
Roger D'Aprix in Communicating for Change

4.1. Processes Occurring.

Largely spurred by the writing of Marshall Ogarkov in the late 1970s and early 1980s as well as the review of the demonstrated success of the technologically superior U.S. force in Desert Storm, a great interest developed to explore the concepts of an RMA. In the early 1990s, the Office of the Secretary of Defense (OSD) and each of the services sponsored roundtables and forums on RMA, several defense analysts wrote articles on the subject, the academic strategic studies communities concentrated in the area, the Army War College and the Strategic Studies Institute had RMA as the theme for

its annual strategy conference in 1994, and defense-related think-tanks and consulting firms were engaged under contract.

Recently it appears that the further development has revolved around two possibly disjoint groupings. First there exists a "sponsored" element that is using the efforts of Science Applications International Corporation (SAIC), under contract initiated with the Office of the Secretary of Defense's Net Assessment Office, to organize and structure efforts. The results are focused work to simulate RMA concepts and to analyze results through a series of workshops and games. Within the Army, the focus centers around the concept of Dominating Maneuver, but the expectation is that intersection of the areas of Information Warfare, Precision Strike, Space Warfare, and Dominating Maneuver will be the revolution in warfare (Figure 2).[45]

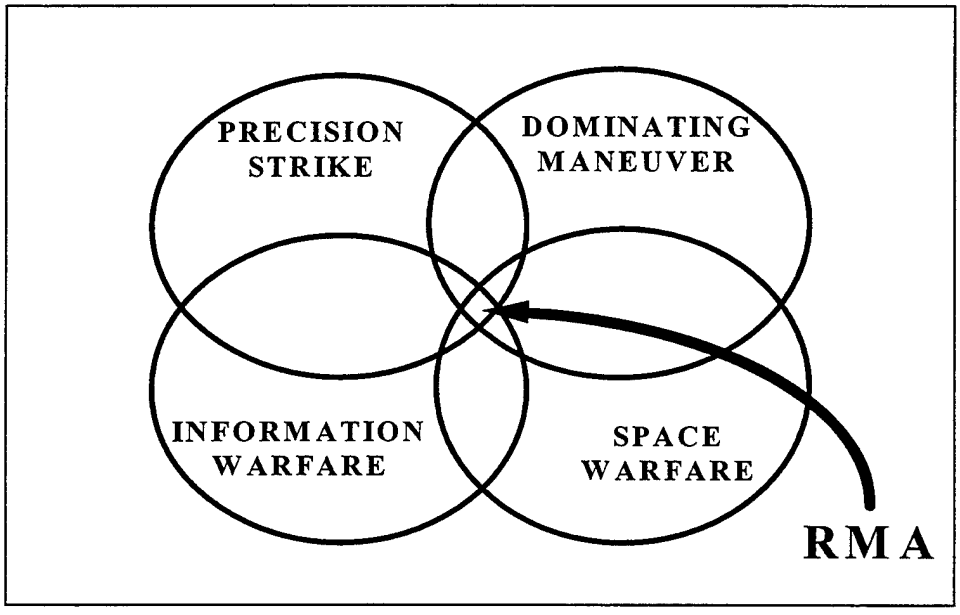

Figure 2[46]

The second group is primarily independent actors who postulate several different approaches to the RMA. Included in this group are those that recognize the RMA as being the "system of systems" breakthrough achieved by the convergence of the technical advances of precision force, C4I (command, control, communications, computer, and intelligence processing), and ISR (intelligence collection, surveillance, and reconnaissance) to give dominant battlespace knowledge (Figure 3). Another of this grouping argues that the basis for the RMA is information, built around computers, communications systems, satellites, and sensors.[47] The result is that in the community there is ambiguity in determining the basis for a present day RMA.

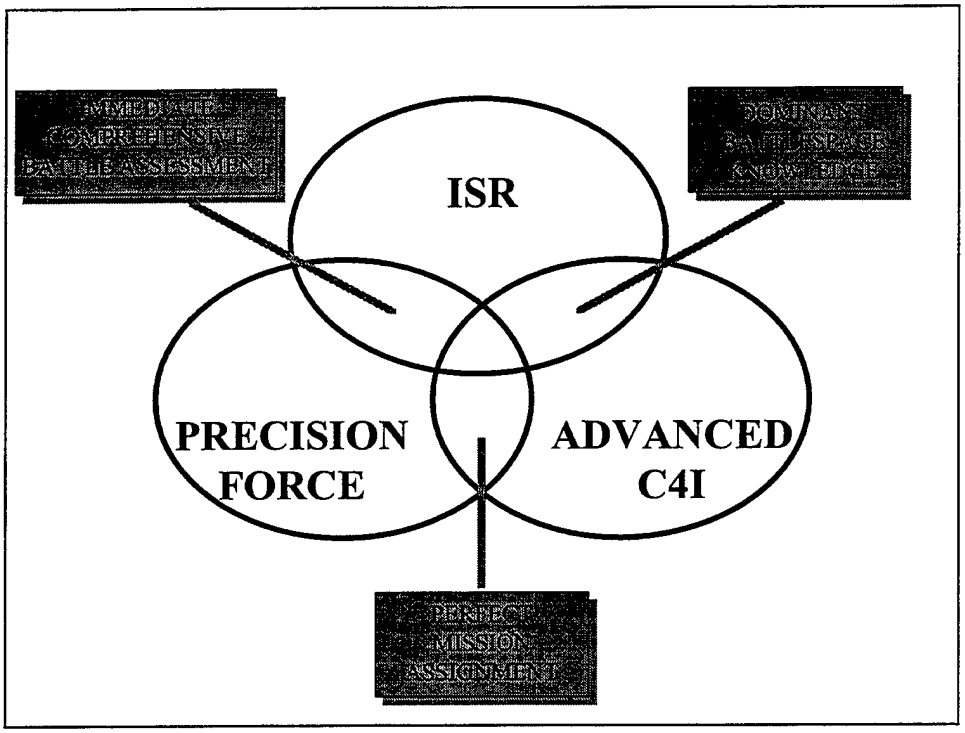

Figure 3[48]

Significantly, the examination of the two groups also identifies disjointness in the timeframe seen for an RMA to occur. The SAIC based group is clearly focused on the 2020 timeframe and fits handily with the AAN study. Conversely, the other group predominantly sees the RMA in progress now and the prospect for implementation in the near to mid term. This group relates more closely to the concepts and timeframe laid out in Army Vision 2010. This picture of different views towards the RMA highlights the difference between the AAN and the Army Vision 2010 and the Force XXI effort. The Force XXI effort in this analysis, in fact, is not seen as an RMA, but more as an MTR.

4.2. Proposed Action and Implementation.

The best course of action for the Army is to not evolve through a Force XXI process and build to the 2025 AAN RMA. The reasons that support the assertion that an RMA occur without delay have been outlined. In addition to the ubiquity and pace inherent in the Information Age explosion, the budgetary savings promised by the "accelerated RMA force," and the enhancements of a modernized capabilities-based force, a focus on an RMA now blocks the opportunity for a leap-ahead by an adversary. Moreover, the existence of a "strategic lull" in the security environment supports it happening now rather than as a reaction to an ominous threat.

Paramount to success in executing major action that effects the execution of the National Military Strategy is to have a process to guide the way. The process that guides the RMA must be clear. It inherently requires strong leadership to take the initiative despite the risks to "traditional" ideology (structure and doctrine). The process requires

at a minimum a vision and an execution plan that brings direction for radical change. The disjointness in the current RMA discussions needs to be focused. Effort is minimized if RMA concentration is split with differences in what the RMA is to be and when it is to occur. Undeniably, the Army started the movement with the Force XXI initiative. Its greatest accomplishment is that it started the thinking process. Dramatic action must now happen to take the Army to that envisioned in Army Vision 2010.

The following ideas are illustrative of type of possibilities that are sometimes offered as the RMA basis: removal of all brigade headquarters structure, full implementation of Admiral Owen's "System of Systems" concept, addition of Information Warfare platoons organic to Infantry Battalions, creation of counter-terrorists battalions, structure of all C4I providers under a joint command, alignment of the USMC under the USA, a complete reengineering of the PPBES process, et. al. However, attempts to identify specific, monaural changes, or "silver bullets," as the basis of an Information Age RMA are flawed. That process ignores the fact that information technology is not a single invention, but a complete change in the way of doing business.

Additionally, to simply recognize the benefits of information technology and let the MTR and modernization continue does not recognize the environment as described. The Information Age has occurred because of the advances in information technology. The previously described revolutionary nature of the information technology advances are what has caused the RMA introspection. Certainly there are other technology advances that are significantly contributing to the enhancement of warfighting capability,

e.g., the development of "own the night" equipment that has given the U.S. remarkable advantage. But these advances have not generated the impetus for the RMA. Whereas other developments are evolutionary, the continuing exponential development of information technology is revolutionary. The Information Age is what Sullivan and Dubik acknowledged as the driver for change.

Viewing today's environment in the same nature as the Napoleon "nation in arms" RMA would be most appropriate because of the similar ubiquity. The movement into the Information Age, the result of the information technology advances, is currently a driving dynamic throughout all areas of the environment, to include economic, political, and social, as well as military. This ubiquity is even shown by the National Security Agency perception that today information technology is the "threat" replacing what was the Cold War Soviet Union. As such, the process to follow today must recognize the magnitude of the Information Age and then affect the combination of the organizational and operational concepts necessary to maximize the information technology.

Reluctance to start the RMA process is to be expected. The change will mean dramatic new ways of business. In their book, Paradigm Shift, Don Tapscott and Art Caston describe business operations in the Information Age. They discuss how the business world faced the impact of the Information Age and either changed/reengineered and reorganized or failed and succumbed. The authors go on to describe the difficulty in accepting the need for change:

> New paradigms are nearly always received with coolness, even mockery or hostility. Those with vested interests fight the change. The shift demands such a different view of things that established leaders are often the last to be won over, if at all.[49]

As the direction for the future is developed, it is prudent to remember that although the change is hard, the best course of action is for the experts from within the military to drive it; not the budget concerned Congress nor Administration.

Before meaningful direction can be provided for the RMA the responsible leader must be identified. That designated official must be empowered and required to act. That requires full authority to execute all aspects of the implementation as it is designed. Additionally, all complementary efforts, such as the Army Digitization Office, must be under his purview so that synergy is maximized and duplication reduced.

The need to have a single accountable agent empowered to direct and act cannot be discounted nor overstated. The Defense Science Board affirmed this lesson in a recently published study on the precarious Information Age threat posed to U.S. security by the impotent and immature defensive Information Warfare (IW) capability. The Board's top and "most important" recommendation to the Secretary of Defense was that the Department of Defense "designate an accountable IW focal point."[50] The argument is an even more compelling one for the Information Age driven RMA. Since the RMA will affect the basic and complete composition of the Army, it will need direct day to day oversight by the top leadership. It should certainly receive at least the degree of attention that the QDR efforts have received, and, as such, there should be at least equivalent direct oversight -- the Assistant to the Vice Chief of Staff of the Army.

The first action necessary after the definition of the RMA and the designation of the responsible leader, is a depiction of what the future will look like in order to formulate the direction: the vision. A vision is an "articulation of expectations."[51] It depicts the "ends" in the ends, ways, and means paradigm. Army Vision 2010 is well-suited to provide the focus for an Information Age RMA. It provides the image that when fully developed will consummate an RMA. The "full spectrum dominance" Army implies not only the need for the Army to employ information technologies to enhance warfighting capability, but also the changes to organizations and operations to provide the flexible and agile land force required but not in existence today.

The vision alone will not produce the desired result. It must be complemented with a well-conceived and articulated plan to direct execution. The identification of the "ends" sans the "ways" will not attain the desired result. An implementation plan to complement Army Vision 2010 needs to be built. The Army experienced this lesson in the development of the strategy to formulate the C4I future. In 1993, recognizing the implications on the horizon, a vision document was written to provide "a single, unified vision for the C4I community" that would accomplish "a seamless information architecture from the sustaining base to the foxhole." The result, The Enterprise Strategy, was a well thought out and articulated vision that identified ten principles to follow for success. In actuality, the principles were simply well articulated descriptions for success. More importantly, it was recognized that there was the need for a plan of execution to provide the direction and process for action, achieve product development, and organize effort and appoint responsibility. Immediately following the publishing of

the vision document, the Enterprise Implementation Plan was published. The result was the development of focused teamwork to develop the Army's C4I architecture. The Army Technical Architecture, one of the tasks delineated in the Enterprise Implementation Plan, has even been adopted by the Department of Defense as the basis for the Joint Service Technical Architecture.[52]

The development of the RMA implementation plan is undoubtedly the hardest thing to do in the range of hard things to do to enact an RMA. The Force XXI effort is an excellent program to introduce concepts and experiment with technology and ideas. However, it is too costly in both time and dollars to provide the required force for the Information Age RMA. The experimentation with ideas and technology provides valuable insight for further development and adoption. However, the current process strives for fielding the 100% solution. It needs to be more flexible, or it is a process that will result in evolutionary development, and end up with the AAN as the guide to RMA efforts.

The development of the implementation plan must recognize that requiring the 100% solution in Information Age environment is an archaic and an ineffective approach. In fact, in the last decade our warfighting divisions have each negated that methodology. They have all, on their own, developed automation capability to take to the field to enhance capabilities the Army provided. These were devices that were directly connected to the communications architecture that existed, through modems with the IATACS (Improved Army Tactical Communications System) and then by direct connects to the

MSE (Mobile Subscriber Equipment) systems. They were developed with the "current" off-the-shelf automation system equipment and a relatively small amount of funds, i.e., $2 million. Additionally, they then became useful systems in the garrison environment. Strikingly, approved systems fielded at much greater cost, i.e., MCS (Maneuver Control System), were not as well-employed. The same sorts of occurrences have happened in the communications environment. Divisions have increasingly employed off-the-shelf technology to provide necessary capability. The proliferation of cellular phones, "brick" radios, INMARSAT (INternational MARitime SATellite) terminals, commercial video teleconference systems and large bandwidth transmission paths, etc. has occurred on the battlefield (i.e., Somalia, Haiti, and Bosnia).

The bottom line is that the old paradigm of acquisition fielding is not adequate for the RMA. A 100% solution that is costly in both time and dollars is not as effective and therefore not as desirable as the 80% solution that can be fielded to provide enhancements today and that will expedite the RMA. An institutional change to the Force XXI effort to accommodate this process is required. A review of the successful concepts from the 9th Motorized Division method where quick testing and evaluation of systems and ideas were promoted, without stifling bureaucratic ties, would be fruitful and might lead to a better method.

One final aspect essential to the development of an implementation plan is the assurance of a method to institutionalization the RMA. The character of men and women in uniform is the foundation for continuance of the RMA initiatives. Unless a corps of

officers and soldiers are formed with the RMA concept, the RMA process will end up being sluggish at best, and possibly a failure. There must be a group culture developed with an ethos to support the implementation of an Information Age RMA. The current work by the Officer Personnel Management System (OPMS) XXI Task Force to build an officer corps that fosters an Information Operations career field with several independent functional area specialties is not only a good attempt, but a necessity. The proposal not only creates an Information Operations Career Field that fosters growth for the information operations officers, but it establishes the recognition within the entire officer corps of the changed environment and the focus of the Information Age.

Similarly, there needs to be an understanding that a different type of soldier is required. It is generally believed that as the infusion of technology is dramatically increased and the operational units are developed to employ the Information Age RMA concepts, a high-quality troop is an absolute. Michael Mazarr argues that this lesson stands out as one that is especially important in the discussion of the Information Age RMA. He states, "Only highly intelligent, superbly trained, well-equipped troops with high morale and wide experience will be able to flourish in the incredibly demanding atmosphere of future war."[53] The RMA implementation process must ensure attention is so focused.

In review, the steps for the RMA have been described. The first thing necessary is the acceptance of the INSS definition to focus efforts. Secondly, a vision needs to provide the goal state; and Army Vision 2010 does that. Lastly, a single, directed implementation plan needs to be promulgated. The development of the specifics of that

are complex and require concerted attention. To accomplish this development and to ensure successful follow-on requires top-level support, defined responsibility, and institutional cultural change. Those are aided by the appointment of a single, high level leader and personnel management changes to the force.

5.0. CONCLUSION.

> ***"The willingness of the U.S. military leadership to pursue new opportunities offered by the rapid advances in technology and to embrace new organizational and operational techniques will go a long way to determining success on the battlefield of the future."***
> ***Strategic Assessment 1996 by INSS, NDU***[54]

It is universally accepted that history provides valuable lessons to aid in understanding the past which can be helpful in directing present day activities. The conduct of warfare is no exception. The movement into a new "age", the Information Age, has monumental implications for the military. Insight on how the Army should proceed can be gathered from history. The Revolution in Military Affairs process attempts to do this. Although RMAs have happened in the past and have been studied, the definition and classification of these radical change events as "revolutions in military affairs" is recent, as is the opportunity to recognize the present day environment as one that fits within that study. This uniqueness and new terminology allows fuzziness in the concept, and that in turn allows for various interpretations and uncertainty.

It is important to understand the implications and processes of an RMA. The community must overcome any bias that may exist in the study of the topic, to include even superficial ones induced by the terminology, and focus on the lessons of history. The clear understanding of what is involved is paramount to apply history's lessons. That

requires clear definition and an understanding that an RMA entails an active change to technology, operations and organization. Consensus on this allows for the recognition of how to apply history's lessons in the current Information Age environment.

In order to affect necessary change, a vision for future warfare in the Information Age is necessary but not sufficient. After the recognition must come the implementation. The result of an inadequate game plan to bring about the RMA is a military technical revolution (MTR), where the Army simply incorporates technological enhancements. An evolution occurs with an MTR, but the change necessary for the U.S. Army in the Information Age does not. An implementation plan is key to execution. A clear delineation of what and how things will be done to accomplish a vision is as important as a Course of Action paragraph is to a Mission paragraph in an Operations Order.

One can look to history to see the consequences of recognition without implementation. The enhancements of the tank, radio, and airplane were introduced in World War I. Their revolutionary impact was recognized and developed during the inter-war period by the Germans who demonstrated that recognition and effective implementation at the start of World War II, 20 years later, with the Blitzkrieg. Conversely, on the other side of Atlantic during the inter-war period, a major named Dwight David Eisenhower, on writing and discussing revolutionary application of tank warfare, was warned to keep his ideas to himself or face a court-martial.[55]

The U.S. Army has started the process for implementing an RMA. But the process is only in the elementary stage. To continue is uncomfortable, but an uncomfortable situation now is better than an intolerable situation in 2015. As a final

note, a revisiting of the Chairman's warning is worthwhile, "We are in the midst of a revolution in military affairs. -- If there is one certainty, it is that the revolution will cause us to either maintain our edge or lose it."[56]

ENDNOTES

[1] Roger C. Molander, Andrew S. Riddle, and Peter A. Wilson, "Strategic Information Warfare: A New Face of War," Parameters 26 (Autumn 1996): 81.

[2] General John M. Shalikashvili, "A Word from the Chairman," Joint Force Quarterly 12 (Summer 1996): 5.

[3] Ibid.

[4] Secretary of Defense William S. Cohen, <SECDEF WASHINGTON DC //OASD:PA/DDI//>, "DOD NEWS BRIEFING - CONDUCTED ON TUESDAY, MARCH 18, 1997 - 3:30 P.M. (EDT)," official AUTODIN message to AIG 8775, DTG 182307Z MAR 97.

[5] Laura Peters, "Future Microprocessors," PC Magazine, 25 March 1997, 168-169, and Michael J. Miller, ed., "The Microprocessor at 25," PC Magazine, 17 December 1996, 148-149, and "Moore's Law," <http://www.intel.com/product/tech-briefs/man_bnch.htm/>, 23 March 1997.

[6] Michael J. Miller, "Microprocessors March On," PC Magazine, December 17, 1996, 4.

[7] Peters, 169.

[8] Bill Gates, "Looking Beyond with Bill Gates and Gordon Moore," interview by PC Magazine, 25 March 1997, 232.

[9] Hans Binnendijk and Patrick Clawson, eds., Strategic Assessment 1996: Instruments of U.S. Power (Washington: National Defense University Press, 1996), 198.

[10] Department of Defense, Defense Science Board Task Force, Information Warfare - Defense (IW-D) (Washington: U.S. Department of Defense, November 1996), 2-1.

[11] Binnendijk, Strategic Assessment 1996: Instruments of U.S. Power, 185.

[12] General Gordon R. Sullivan and Colonel James M. Dubik, War in the Information Age (Carlisle Barracks: Strategic Studies Institute, 6 June 1994), 12.

[13] Steven Metz and James Kievit, The Revolution in Military Affairs and Conflicts Short of War (Carlisle Barracks: Strategic Studies Institute, 6 June 1994), 28.

[14] Ibid., 1.

[15] Lieutenant Colonel Steve Lindberg and Lieutenant Colonel Robert Kilmer, "Classnotes, Lesson 1," class notes for Revolution in Military Affairs class, U.S. Army War College Advanced Course Class 598j, 15 January 1997, 2.

[16] Jeffrey R. Cooper, Another View of the Revolution in Military Affairs (Carlisle Barracks: Strategic Studies Institute, 15 July 1994), 27.

[17] Steven Metz and James Kievit, Strategy and the Revolution in Military Affairs: From Theory to Policy (Carlisle Barracks: Strategic Studies Institute, 27 June 1994), 2.

[18] Jeffrey R. Cooper, Another View of the Revolution in Military Affairs, (Carlisle Barracks: Strategic Studies Institute, 15 July 1994), 40.

[19] Binnendijk, Strategic Assessment 1996: Instruments of U.S. Power, 198.

[20] Lieutenant General John S. Fairfield, "The Air Force Software Perspective," CrossTalk 9 (October 1996): 5.

[21] Binnendijk, Strategic Assessment 1996: Instruments of U.S. Power, 198.

[22] Ibid.

[23] Metz, Strategy and the Revolution in Military Affairs: From Theory to Policy, 3.

[24] Ibid., 9.

[25] Cooper, 13-15.

[26] Ibid., 20-21.

[27] Ibid., 14-15.

[28] Ibid., 20-21.

[29] Binnendijk, Strategic Assessment 1996: Instruments of U.S. Power, 198.

[30] Chief of Staff, Army, <DA WASHINGTON DC//DACS-ZA//>, "LAM TASK FORCE - INSTITUTIONALIZING FUNCTIONS," official AUTODIN message to ALARCAT, DTG 051700Z APR 96.

[31] Binnendijk, Strategic Assessment 1996: Instruments of U.S. Power, 172-173.

[32] Department of the Army, Army Digitization Master Office, Army Digitization Master Plan, (Washington: U.S. Department of the Army, 1996), 1-2.

[33] Douglas Johnson and Steven Metz, "The Theology of the Army After Next," briefing slides for briefing at Army War College, 5 November 1996, 2.

[34] Lindberg, 12.

[35] Department of the Army, Office of Public Affairs, "Army Releases 'Army Vision 2010,'" <http://www.army.mil/APA/news_release2010.htm/>, 17 December 1996.

[36] Department of the Army, Army Vision 2010, (Washington: U.S. Department of the Army, November 1996), 2.

[37] Hans Binnendijk and Patrick Clawson, eds., Strategic Assessment 1997: Flashpoints and Force Structure (Washington: National Defense University Press, 1997), xv.

[38] Rowan Scarborough, "Pentagon Eyes Cuts, Peacekeeping Focus," Washington Times, December 13, 1996, p.1.

[39] Department of the Army, Army Vision 2010, 7.

[40] Scarborough, 1.

[41] Binnendijk, Strategic Assessment 1997: Flashpoints and Force Structure, 88-89, 236-237.

[42] Ibid., xii.

[43] Ibid., 241-242.

[44] Roger D'Aprix, Communicating for Change, (San Francisco: Jossey-Bass, 1996), 8.

[45] Science Applications International Corporation, Strategic Assessment Center, "The Revolution in Military Affairs," <http://sac.saic.com/Rmapaper.htm/>, 13 April 1997.

[46] Jim Blackwell, "Revolution in Military Affairs: Dominating Maneuver," briefing slides for Revolution in Military Affairs class, U.S. Army War College Advanced Course Class 598j, 21 January 1997, 3.

[47] Michael J. Mazarr, The Revolution in Military Affairs: A Framework for Defense Planning, (Carlisle Barracks: Strategic Studies Institute, 15 July 1994), 8, 23.

[48] Admiral William A. Owens, "The American Revolution in Military Affairs," Joint Force Quarterly 10 (Winter 1995-96): 37.

[49] Don Tapscott and Art Caston, Paradigm Shift: The New Promise of Information Technology (New York: McGraw-Hill, Inc., 1993), 26.

[50] Department of Defense, Defense Science Board Task Force, Information Warfare - Defense (IW-D) (Washington: U.S. Department of Defense, November 1996), ES5.

[51] General (ret) Gordon R. Sullivan, "Reflections on Leadership," briefing at U.S. Army War College, 11 December 1996.

[52] Department of the Army, Office of the Director of Information Systems for Command, Control, Communications, and Computers, Army Enterprise Strategy: The Vision (Washington: U.S. Department of the Army, 1993) and The Army Enterprise Implementation Plan (Washington: U.S. Department of the Army, August 1994).

[53] Mazarr, 29.

[54] Binnendijk, Strategic Assessment 1996: Instruments of U.S. Power, 184.

[55] Robert H. Berlin, "Dwight David Eisenhower and the Duties of Generalship," Military Review (October 1990): 16.

[56] Shalikashvili, 5.

BIBLIOGRAPHY

Alacala, Raoul H. "Guiding Principles for Revolution, Evolution, and Continuity in Military Affairs," in Wither the RMA: Two Perspectives on Tomorrow's Army, by Paul J. Braken and Raoul H. Alacala, 15-46. Carlisle Barracks: U.S. Army War College, Strategic Studies Institute, 22 July 1994.

Berlin, Robert H. "Dwight David Eisenhower and the Duties of Generalship." Military Review (October 1990): 15-25.

Binnendijk, Hans. "A Strategic Assessment for the 21st Century." Joint Force Quarterly 13 (Autumn 1996): 67-68

Binnendijk, Hans and Patrick Clawson, eds. Strategic Assessment 1996: Instruments of U.S. Power. Washington: National Defense University, Institute for National Strategic Studies, 1996.

_____. Strategic Assessment 1997: Flashpoints and Force Structure. Washington: National Defense University, Institute for National Strategic Studies, 1997.

Blackwell, Jim. "Revolution in Military Affairs: Dominating Maneuver." Briefing slides for Revolution in Military Affairs class at U.S. Army War College Advanced Course Class 598j. 21 January 1997.

Bracken, Paul J. "Future Directions for the Army," in Wither the RMA: Two Perspectives on Tomorrow's Army, by Paul J. Braken and Raoul H. Alacala, 1-14. Carlisle Barracks: U.S. Army War College, Strategic Studies Institute, 22 July 1994.

Braim, Paul F. "An Earlier Revolution in Military Affairs." Parameters Vol. XXVI, No. 3 (Autumn 1996): 152-154.

Brown, Michael L. "The Revolution in Military Affairs: The Information Dimension." In Cyberwar: Security, Strategy, and Conflict in the Information Age, ed. Alan D. Campen, Douglas H. Dearth, and R. Thomas Gooden, 31-52. Fairfax: AFCEA International Press, May 1996.

Campen, Alan D. "Uncommon Means for the Common Defense." In Cyberwar: Security, Strategy, and Conflict in the Information Age, ed. Alan D. Campen, Douglas H. Dearth, and R. Thomas Gooden, 71-76. Fairfax: AFCEA International Press, May 1996.

Casper, Lawrence E., Irving L. Halter, Earl W. Powers, Paul J. Selva, Thomas W. Steffens, and T. LaMar Willis. "Knowledge-Based Warfare: A Security Strategy for the Next Century." Joint Force Quarterly 13 (Autumn 1996): 81-89.

Cohen, William S. <SECDEF WASHINGTON DC //OASD:PA/DDI//>, "DOD NEWS BRIEFING - CONDUCTED ON TUESDAY, MARCH 18, 1997 - 3:30 P.M. (EDT)." Official AUTODIN message to AIG 8775, DTG 182307Z MAR 97.

Cooper, Jeffrey R. Another View of the Revolution in Military Affairs. Carlisle Barracks: U.S. Army War College, Strategic Studies Institute, 15 July 1994.

D'Aprix, Peter. Communicating for Change: Connecting the Workplace with the Marketplace. San Francisco: Jossey-Bass Publishers, 1996.

Dearth, Douglas H., and Charles A. Williamson. "Information Age/Information War." In Cyberwar: Security, Strategy, and Conflict in the Information Age, ed. Alan D. Campen, Douglas H. Dearth, and R. Thomas Gooden, 13-30. Fairfax: AFCEA International Press, May 1996.

Fairfield, Lieutenant General John S. "The Air Force Software Perspective," CrossTalk 9 (October 1996): 3-5.

Gates, Bill. "Looking Beyond with Bill Gates and Gordon Moore," interview by PC Magazine, 25 March 1997, 229-239.

Heinlein, Robert A. Starship Troopers. New York: Ace Books. 1959.

Intel Corporation. "Moore's Law," <http://www.intel.com/product/tech-briefs/man_bnch.htm>. 17 April 1997.

Jablonsky, David. The Owl of Minerva Flies at Twilight: Doctrinal Change and Continuity and the Revolution in Military Affairs. Carlisle Barracks: U.S. Army War College, Strategic Studies Institute, July 1995.

Johnson, Douglas and Steven Metz. "The Theology of the Army After Next." Briefing slides for briefing at Army War College, 5 November 1996.

Lindberg, Lieutenant Colonel Steve and Lieutenant Colonel Robert Kilmer. "Classnotes, Lesson 1." Class handout for Revolution in Military Affairs class, U.S. Army War College Advanced Course Class 598j, 15 January 1997.

Link, Charles D. "21st Century Armed Forces - Joint Vision 2010." Joint Force Quarterly 13 (Autumn 1996): 69-73.

Mazarr, Michael J. The Revolution in Military Affairs: A Framework for Defense Planning. Carlisle Barracks: U.S. Army War College, Strategic Studies Institute, 10 June 1994.

Metz, Steven. Strategic Horizons: Speculations on the Future Security System. Carlisle Barracks: U.S. Army War College, Strategic Studies Institute. 4 October 1996 (Draft).

Metz, Steven, and James Kievit. The Revolution in Military Affairs and Conflict Short of War. Carlisle Barracks: U.S. Army War College, Strategic Studies Institute. 25 July 1994.

_____. Strategy and the Revolution in Military Affairs: From Theory to Policy. Carlisle Barracks: U.S. Army War College, Strategic Studies Institute. 27 June 1995.

Metz, Steven, William T. Johnsen, Douglas V. Johnson II, James Kievit, and Douglas C. Lovelace, Jr. The Future of American Landpower: Strategic Challenges for the 21st Century Army. Carlisle Barracks: U.S. Army War College, Strategic Studies Institute. 12 March 1996.

Miller, Michael J. "Microprocessors March On." PC Magazine, December 17, 1996, 4.

Miller, Michael J., ed. "The Microprocessor at 25." PC Magazine, 17 December 1996, 147-149.

Molander, Roger C., Andrew S. Riddle, and Peter A. Wilson. "Strategic Information Warfare: A New Face of War." Parameters 26 (Autumn 1996): 81-92.

Morse, David. Cyber Dictionary: Your Guide to the Wired World. Santa Monica: Knowledge Exchange, LLC. 1996

Murray, Williamson. "Innovation: Past and Future." Joint Force Quarterly 12 (Summer 1996): 51-60.

National Research Council, Board on Army Science and Technology. STAR 21: Strategic Technologies for the Army of the Twenty-First Century. Washington: National Academy Press. 1992.

Nunn, Sam. "Future Trends in Defense Organization." Joint Force Quarterly 13 (Autumn 1996): 63-66.

Owens, Admiral William A. "The American Revolution in Military Affairs," Joint Force Quarterly 10 (Winter 1995-96): 37-38.

Peters, Laura. "Future Microprocessors." PC Magazine, 25 March 1997, 168-169.

Reimer, General Dennis J. <DA WASHINGTON DC//DACS-ZA//>, "LAM TASK FORCE - INSTITUTIONALIZING FUNCTIONS." Official AUTODIN message to ALARCAT, DTG 051700Z APR 96.

Scarborough, Rowan. "Pentagon Eyes Cuts, Peacekeeping Focus." Washington Times, 13 December 1996, p.1.

Science Applications International Corporation. Strategic Assessment Center. "The Revolution in Military Affairs." <http://sac.saic.com/Rmapaper.htm/>. 13 April 1997.

Shalikashvili, General John M. "A Word from the Chairman." Joint Force Quarterly 12 (Summer 1996): 1-5.

Sullivan, General (ret) Gordon R. "Reflections on Leadership." Briefing at U.S. Army War College. 11 December 1996.

Sullivan, General (ret.) Gordon R., and Colonel James M. Dubik. War in the Information Age. Carlisle Barracks: U.S. Army War College, Strategic Studies Institute. 6 June 1994.

Sullivan, General (ret) Gordon R., and Lieutenant Colonel Anthony M. Coroalles. The Army in the Information Age. Carlisle Barracks: U.S. Army War College, Strategic Studies Institute, 31 March 1995.

Tapscott, Don, and Art Caston. Paradigm Shift: The New Promise of Information Technology. New York: McGraw-Hill, Inc., 1993.

Tilford, Earl H. The Revolution in Military Affairs: Prospects and Cautions. Carlisle Barracks: Strategic Studies Institute, 23 June 1995.

U.S. Department of the Army. Army Vision 2010. Washington: U.S. Department of the Army, November 1996.

U.S. Department of the Army. Army Digitization Master Office. Army Digitization Master Plan. Washington: U.S. Department of the Army, 1996.

U.S. Department of the Army. Office of the Director of Information Systems for Command, Control, Communications, and Computers. Army Enterprise Strategy: The Vision. Washington: U.S. Department of the Army, 1993.

_____. The Army Enterprise Implementation Plan. Washington: U.S. Department of the Army, August 1994.

U.S. Department of the Army. Office of Public Affairs. "Army Releases 'Army Vision 2010.'" <http://www.army.mil/APA/news_release2010.htm/>. 17 December 1996.

U.S. Department of Defense. Defense Science Board Task Force. Information Warfare - Defense (IW-D). Washington: U.S. Department of Defense, November 1996.

U.S. Department of Defense. Defense Science Board 1996 Summer Study Task Force. Tactics and Technology for 21st Century Military Superiority, Volume 1, Final Report. Washington: Office of the Secretary of Defense, October 1996.

Whitney-Smith, Elin. "War, Information and History: Changing Paradigms." In Cyberwar: Security, Strategy, and Conflict in the Information Age, ed. Alan D. Campen, Douglas H. Dearth, and R. Thomas Gooden, 53-69. Fairfax: AFCEA International Press, May 1996.